**Physics Lab**

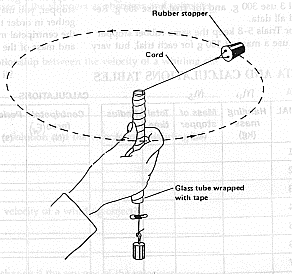
**Centripetal Force and Speed**

**Purpose:**

The purpose of this lab is to investigate the relationship between the speed of an object in uniform circular motion and the centripetal force on the object.

**Equipment:**

* centripetal force apparatus
* safety glasses
* washers or weights
* meter stick
* stopwatch
* data & analysis sheet
* Paper clip



**Discussion:**

An object moving in a circle at constant speed is accelerating because the direction of the velocity is changing. Since the change in velocity is directed towards the center of the circle the acceleration is called centripetal acceleration. The force required to produce this acceleration is called the centripetal force. Any net force that causes an object to move in a circular path can be a centripetal force.

Fc =mv2/r

The equation relating centripetal force, mass and velocity is

where *Fc* is the centripetal force, *m* is the mass of the object, *v* is the velocity and *r* is the radius.

**Procedure:**

Thread the string through the hole in the rubber stopper and tie the string back onto itself. Pass the other end through the tube and fasten the mass to be used to it. Hold the tube in one hand while supporting the mass in the other. Whirl the rubber stopper overhead slowly to make a horizontal circle. The paper clip is use to mark a constant radius if it almost touches the bottom of the tube when stopper is moving in a circular path. Make sure that the paper clip does not touch the bottom of the rod so that frictional forces are not introduced. You need to practice your whirling technique so that the paper clip stays just below the bottom of the tube.

Use a stopwatch to measure the time taken for 20 revolutions. Record your data. Change the number of masses on the bottom clip (centripetal force) for five different weights. Record the data.

* Determine the mass of the stoppers in kilograms.
* Determine the radius of the circle in meters.
* Calculate the period of revolution, T (the time to go around once) for each trial.
* Calculate the speed, v, of the stopper for each trial.
* Calculate Force on the stoppers according to the equation F= mg where “m” is the mass in kilograms of the weights producing the centripetal force.

## Results:

1. The centripetal force should be directly proportional to the ***square*** of the speed. Construct a graph of centripetal force versus v2.  Draw the ***best smooth curve*** through your data points and determine the slope.
2. Determine m/r. Divide the value of m by the value of r to determine the known value for m/r. Record the value.
3. Calculate % error. Calculate and record the [percent error](javascript:equation('cfpercenterrorequation1.html','equation','400','260','yes',0)) in your experimental value (m/r)exp (slope of the line) compared to the known value of m/r.

## Conclusions:

Is the graph of centripetal force versus speed squared a straight line?

What is the relationship between force and speed?